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CLINICAL REPORT

Percutaneous intradiscal high-pressure injection of saline and lidocaine in patients with lumbar intervertebral disc extrusion

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Abstract The intradiscal high-pressure injection of saline and lidocaine (IDHP) is a minimally invasive percutaneous procedure for a lumbar intervertebral disc extrusion. The purpose of this study was to investigate the clinical outcomes of IDHP in terms of pain relief, reduction of disability, and risk of complications. Thirty patients with primarily radicular pain due to an extrusion-type disc herniation who underwent IDHP were enrolled in the study. A visual analogue pain scale (VAS) and the Japanese Orthopedic Association (JOA) scoring system for the treatment of low back disorders were used at pre-treatment, 2 weeks post-treatment, and 3 months post-treatment. The mean VAS decreased significantly ($p < 0.01$) from 64.3 mm at pre-treatment to 26.3 mm at 2 weeks post-treatment and 15.5 at 3 months post-treatment. The mean JOA score improved significantly ($p < 0.01$) from 14.7 to 21.3 at 2 weeks post-treatment and 24.6 at 3 months post-treatment. IDHP appeared to produce significant effects in patients with radicular pain, leading to the improvement of VAS and JOA scores. IDHP appears to be a safe, minimally invasive treatment option for a lumbar intervertebral disc extrusion.

Keywords Lumbar disk herniation · Percutaneous technique · Intradiscal injection

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Introduction

Conventional open lumbar discectomy is the standard treatment for leg pain caused by radiculopathy from extruded large disc herniations that fail to respond to non-operative management [1]. In recent years, there has been a general trend in spinal surgery toward reductionism and minimalization. For this purpose, percutaneous minimally invasive intradiscal techniques for protruded lumbar disc herniation have been developed [2–4].

Lemcke et al. [3] have reported on various percutaneous treatments for protruded lumbar disc herniation (a condition which implies no posterior longitudinal ligament damage, so that the nuclear material is contained). However, previously, there has been no percutaneous treatment for extruded lumbar disc herniation (a condition which implies a complete tear in the annulus fibrosis, allowing nuclear material to seep out into the epidural space) [4].

Intradiscal high-pressure injection of saline and lidocaine (IDHP) [5, 6] is a minimally invasive procedure for leg and low back pain that is caused by radiculopathy arising from lumbar intervertebral disc extrusion. IDHP [5, 6] evolved from discography experiences, where contrast medium or local anesthetics were found to provide long-term relief from symptoms in some patients. IDHP is performed percutaneously with contrast medium, local anesthetics, and corticosteroid, using a discography technique.

However, there has been only one investigation of IDHP in patients with lumbar intervertebral disc extrusion and leg and low back pain caused by radicular encroachment [5].

The purpose of this study was to evaluate the efficacy of the IDHP procedure in terms of pain relief and reduction of disability.

Case reports

Thirty patients (19 male, 11 female) with primary radicular pain due to lumbar intervertebral disc extrusion, diagnosed by magnetic resonance imaging (MRI), who underwent IDHP between October 2005 and March 2011 at the Pain Management Clinic of Shiga University of Medical Science Hospital were enrolled in the study. All patients were diagnosed with extruded lumbar disc herniation by MRI and the major subjective symptoms were leg and low back pain.

A total of 30 procedures were performed in the 30 patients. The mean age of the patients was 42.2 ± 14.4 years. Of the 30 discs treated, 11 were at L4–L5, 14 at L5–S1, 3 at L2–L3, 1 at L3–L4, and 1 was at L5–L6.

All the patients were taking medications, including various non-steroidal anti-inflammatory drugs (NSAIDS) and cyclooxygenase (COX) inhibitors. None of the patients increased the amount of medication, and none changed the type of medication after the IDHP treatment.

The inclusion criteria for receiving IDHP [5, 6] in our study were the following: (1) persistent radicular pain secondary to an extruded herniated disc resistant to previous medical treatment and physiotherapy. (2) Lack of satisfactory improvement with a comprehensively applied non-operative care program including epidural corticosteroid injection, a trial of manual physical therapy, and oral anti-inflammatory medication for 3 weeks. (3) Magnetic resonance imaging (MRI) evidence of extruded disc herniation correlated with the patient's symptoms. The exclusion criteria were a protruded disc herniation on MRI, severe spinal canal narrowing, segmental instability, or psychological issues [5, 6].

The study protocol was approved by the Human Ethics Committee of Shiga University of Medical Science Hospital. The procedure and associated potential complications such as nerve root injuries, epidural space bleeding, and discitis were explained to the patients, and informed consent was obtained before treatment.

The IDHP was performed with the patients lying on a fluoroscopy table in the prone position. A posterior oblique approach allowed visualization of the discs using discography. The discs treated were selected on clinical grounds according to the level of the extruded discs. Under fluoroscopic guidance, a 12-cm, 22-G needle was percutaneously advanced a bit behind the mid-portion of the herniated nucleus pulposus that was responsible for the symptoms. Proper placement of the introducer needle was confirmed with anteroposterior, oblique, and lateral fluoroscopic projections.

After the first discography with 2 ml of contrast medium to identify the silhouette of the disc herniation, a single high-pressure injection of 6–8 ml of normal saline and 8–10 ml of 1 % lidocaine was administered through the needle. Finally, a second discography was performed and another 2 ml of contrast medium mixed with 4 mg of dexamethasone was infused into the disk to prevent potential disk inflammation [5, 6] (Fig. 1). The volume of injected drugs was restricted to about 23 ml.

If the following signs were recognized during the treatment or at the second discography, we regarded the IDHP as successful [5, 6]: (1) apparent loss of injecting resistance, (2) sudden disappearance of reproduced pain, (3) achievement of epidurography (connection from the intradiscal space and herniated nucleus pulposus to the epidural space, movement of contrast medium from the hernia tissue to epidural space) (Fig. 1). After an hour of bed rest, patients were allowed to leave the outpatient room. All procedures were performed on an outpatient basis.

The intensity of the pain was evaluated, using a visual analogue scale (VAS), at pre-procedure, and at 2 weeks and 3 months after the procedure. In addition, we also used the Japanese Orthopedic Association scoring system (JOA score) [7], which was evaluated at pre-procedure, and at

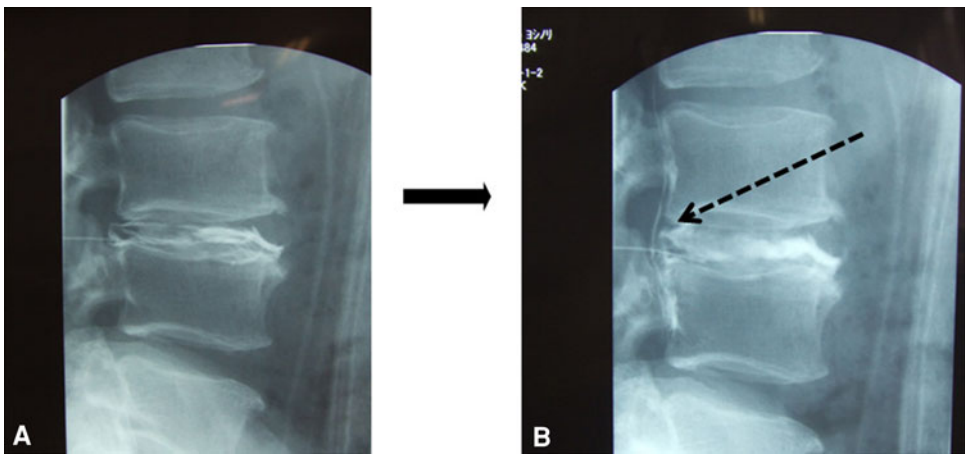

Fig. 1 Intradiscal high-pressure injection of saline and lidocaine (IDHP) procedures. **a** Discography before achievement of epidurography. **b** Movement of contrast medium from herniated discs to the epidural space (i.e., connection from the intradiscal space and herniated nucleus pulposus to the epidural space), *shown by dashed arrow*

Table 1 The Japanese Orthopedic Association scoring system (JOA score)

Subjective symptoms	Score	Clinical signs	Score
Low-back pain		Straight leg-raising test	
None	3	>70° (normal)	2
Occasional mild	2	30–70°	1
Frequent mild or occasional severe	1	<30°	0
Frequent severe	0	Motor function[a]	
Leg pain and/or numbness		Normal	2
None	3	Slight weakness	1
Occasional mild	2	Severe weakness	0
Frequent mild or occasional severe	1	Sensory function	
Frequent severe	0	Normal	2
Walking capacity		Slight weakness	1
No limitation of capacity	3	Severe weakness	0
Able to walk >500 m	2	Bladder function	
Able to walk 100–500 m	1	Normal	0
Able to walk <100 m	0	Mild dysuria	−3
		Severe dysuria	−6
Restriction of activities of daily living[b]			
Turn over while lying	2, 1, 0	Sitting	2, 1, 0
Standing up	2, 1, 0	Lifting	2, 1, 0
Washing face	2, 1, 0	Running	2, 1, 0
Half-sitting position	2, 1, 0		

The Japanese Orthopedic Association scoring system (JOA score) [7] was evaluated at all examination periods. The JOA score is widely used in Japan to evaluate disability associated with low back pain. The JOA score ranges from 29 as the highest positive score to −6 for the worst score

[a] Evaluated using manual muscle testing

[b] Activity: impossible = 0, difficult = 1, easy = 2, total for healthy individuals = 29

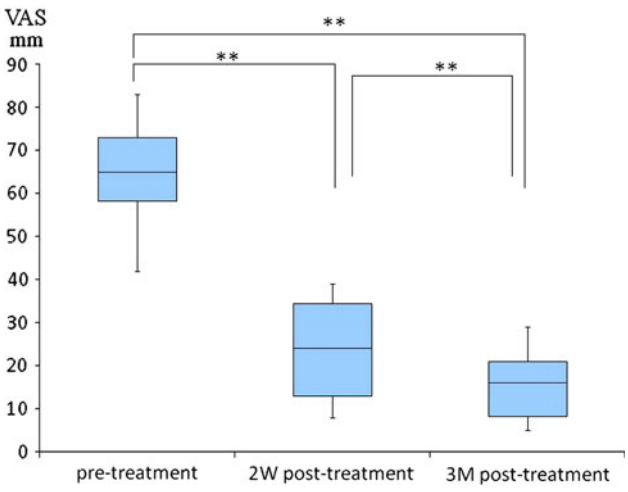

Fig. 2 Mean visual analogue pain scale (*VAS*) scores at pre-procedure and at 2 weeks (*W*) and 3 months (*M*) post-treatment. Wilcoxon signed-rank test $^{**}p < 0.01$

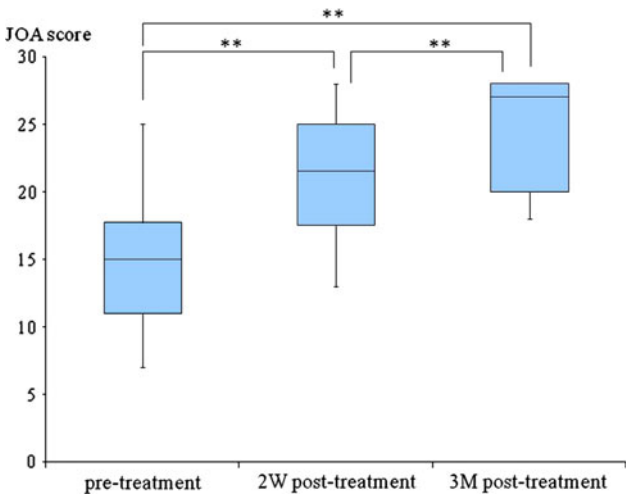

Fig. 3 Mean Japanese Orthopedic Association (*JOA*) scores at pre-procedure and at 2 weeks (*W*) and 3 months (*M*) post-treatment. Wilcoxon signed-rank test $^{**}p < 0.01$

2 weeks and 3 months after the procedure. The JOA score, which is widely used in Japan to evaluate disability arising from low back pain, includes the following items: (1) subjective symptoms, (2) clinical signs, and (3) restriction of activities of daily living. The JOA score ranges from 29 as the highest positive score to −6 for the worst score [7] (Table 1).

The Wilcoxon signed-rank test was applied to evaluate differences in the VAS and JOA scores before and after the procedure. We considered p values of <0.01 to be statistically significant.

The mean pre-operative VAS score was 64.3 ± 11.0 mm (range 42–83). The mean VAS decreased significantly from 64.3 mm at pre-treatment to 23.8 ± 10.3 mm (range 8–39) at 2 weeks post-treatment and 15.5 ± 7.3 mm (range 5–29) at 3 months post-treatment. There were statistically significant decreases in the VAS scores ($p < 0.01$,

Wilcoxon signed-rank test) when compared to the pre-operative values (Fig. 2).

The mean JOA score improved from 14.7 ± 4.2 at pre-treatment (range 7–25) to 21.3 ± 4.1 (range 13–28) at 2 weeks post-treatment and 24.6 ± 4.1 (range 18–28) at 3 months post-treatment (Fig. 3). These increases in the JOA scores were statistically significant ($p < 0.01$, Wilcoxon signed-rank test) when compared to the pre-operative values (Fig. 3).

All the procedures were considered to have been technically successful and there were no complications of nerve root injuries, epidural space bleeding, severe unrelated pain, transient neurological deficit, discitis, or infection related to the procedures. There were no cases of worsening motor or sensory status.

Discussion

Lumbar discectomy is the standard treatment for large disc herniations or extruded fragments that fail to respond to non-operative management [1]. Although the occurrence of spontaneous regression of herniated lumbar discs is around 35–63 % on average, during a period of 6 months to 1 year [8–10], most patients cannot tolerate their symptoms for such a long period of time.

IDHP appeared to produce significant effects in patients with radicular pain, leading to the improvement of VAS and JOA scores.

Based upon our results, IDHP appears to be an effective and promising non-operative treatment for lumbar intervertebral disc extrusion with radiculopathy. IDHP appeared to be an alternative to open discectomy as a non-operative treatment for extruded disc herniation with intractable radicular pain that was resistant to other conservative therapies.

The advantages of IDHP are its percutaneous approach, and the facts that it is an outpatient procedure, only local anesthesia is needed, and the procedure takes a very short time. Hence, the patient can return to normal daily activities in just a few days. The IDHP technique minimizes the invasive nature of surgery and helps to avoid or decrease complications such as fibrosis that are linked to open surgery.

Although the exact mechanism by which IDHP reduces radicular pain is uncertain, it is thought that this procedure decreases radicular pain by two different mechanisms [11, 12]: (1) by flushing pain-related substances out of the nucleus pulposus, discs, and around the compressed nerve root [11]; and (2) by making a passage through the herniated tissue into the epidural space, enabling phagocytes to gather [12].

Although IDHP appears to be a safe, minimally invasive procedure for lumbar intervertebral disc extrusion, the procedure may precipitate further degeneration of the intervertebral disc. Randomized placebo-controlled studies with longer follow-up periods are needed to elucidate the effects of IDHP on low back and leg pain.

In our patients who underwent IDHP for extruded lumbar disc herniation, the procedure appeared to produce significant improvements in terms of pain relief and reduction of disability. IDHP appears to be a safe, minimally invasive treatment option for extruded lumbar disc herniation.

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